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The Graphitizing Behavior of Iron Carbide in Pure Iron Carbon Alloys for the Temperature Interval 700 to 1100 C

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THE GRAPHITIZING BEHAVIOR OF IRON CARBIDE IN PURE IRON CARBON ALLOYS FOR THE TEMPERATURE INTERVAL 700° TO 1100° C.

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(ABSTRACT)

The following reaction represents a possible mechanism for the graphitization of pure iron carbon alloys below the critical range.

(1) $2CO = C + CO_2$
(2) $Fe_3C + CO_2 = 3Fe(alpha) + 2CO$. Adding (1) and (2) gives
(3) $Fe_3C = 3Fe(alpha) + C$

It is shown that if Fe_3C is metastable under a total pressure of one atmosphere, P_2-CO_2 $< P_1$-CO_2, and that P_2-$CO > P_1$-CO where P = partial pressure of the gases in equations (1) and (2) at equilibrium values.

Similarly the following reactions represent a possible mechanism for the graphitization of pure iron-carbon alloys above the critical range.

(4) $2CO = C + CO_2$
(5) $Fe_3C + CO_2 = 2CO + 3Fe$ (gamma in austenite saturated with Fe_3C)
(6) 3Fe (gamma in austenite saturated with Fe_3C) = 3Fe (gamma in austenite saturated with carbon)
(7) $Fe_3C = C + 3Fe$ (gamma in austenite saturated with carbon)

It is shown that if Fe_3C is metastable that a pressure gradient of CO_2 should exist from carbon to Fe_3C and of CO in the opposite direction.

Pure iron carbon alloys are subjected to gaseous mixtures keeping on the CO_2 side of equilibrium values. At a slight depth equilibrium values between CO, CO_2 and C are reached. Beyond this depth the gas mixture catalyses the breakdown of cementite and formation of carbon. The experiment is carried out at 800° C and 927° C at a pressure of 5 atmospheres. Photomicrographs are shown to give evidence of graphitization.

In previous work carried out in this laboratory Fe_3C has been shown to be metastable at 650° C to 700° C. In the present work Fe_3C has been shown to be metastable at 800° and 927° C. The fact is generally accepted that Fe_3C is metastable at temperatures slightly below 1134° C. From this evidence the assumption may be made with a great deal of safety that Fe_3C in contact with C, CO and Co_2 is metastable, under a pressure of 5 atmospheres, thruout the entire critical range. It would be ex-

pected that Fe_3C should also be metastable at a pressure of one atmosphere unless the added pressure of the gases lowers the activity of the Fe and C to such an extent as to change the Fe_3C from a stable to a metastable state.

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A CONTINUOUS READING ELECTRO-TITRATION APPARATUS

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(ABSTRACT)

Goode's Single radio tube electro-titration set up was modified so as to give greater sensitivity. In place of the galvanometer a microammeter reading to 750 microamperes is used in the circuit.

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THE DISSOCIATION OF SOME ORGANIC AND INORGANIC SUBSTANCES AT HIGH TEMPERATURES

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(ABSTRACT)

The following investigation was undertaken to ascertain whether the well known conductivity in many gaseous reactions at high temperatures is due entirely to the reaction or due partially to the dissociation of one or the other or both of the constituents into charged particles.

For the experimental work, a tube 150 mm. long and 15 mm. in diameter containing one platinum and one tungsten electrode was used. The electrodes were of wire and over lapped about 25 mm. and were about three mm. apart. This tube was heated to approximately 500 degrees, this being measured by a pyrometer.

A gentle stream of vapor of the following substances were passed through the tube at atmospheric pressure. A potential of from one to fifteen volts was applied to the electrodes and the current was read by means of a current galvanometer of sensitivity 0.021 microamperes per millimeter division.

The following substances showed a deflection ranging from one to fifteen scale divisions.